DEPARTMENT OF ENVIRONMENTAL QUALITY
PERMITTING and COMPLIANCE DIVISION
MONTANA POLLUTANT DISCHARGE ELIMINATION SYSTEM (MPDES)

Statement of Basis

Permittee:	City of Great Falls
Permit No.:	MT0000442
Receiving Water:	Missouri River
Facility Information:	
Name	Great Falls Water Treatment Plant
Location	1300 Upper River Road Great Falls, MT Cascade County
Facility Contact:	Mike Jacobson, Plant Manager PO Box 5021 1300 Upper River Road Great Falls, MT 59403-5021 (406) 727-1325
Fee Information:	
Number of Outfalls	2
Outfall – Type	001 – Process Water 002 – Process Water

I. Permit Status

This permit is a renewal of the Montana Pollutant Discharge Elimination System (MPDES) permit #MT0000442 for the City of Great Falls (Great Falls) domestic potable water treatment plant (WTP).

The previous permit was issued February 1, 2000 and expired December 31, 2004. Great Falls submitted a renewal application and fee on July 1, 2004. The application was deemed substantially complete by the Montana Department of Environmental Quality (Department) on July 22, 2004.

On July 25, 2008, the Department received an application and fee for a proposed major modification of the facility. On August 22, 2008, the Department returned the MPDES application and requested that Great Falls resubmit it after the city obtained approval for the project design. The Department granted the design approval in accordance with DEQ-2 on October 27, 2008. On December 4, 2008, Great Falls resubmitted the MPDES application package based on the approved upgrade. The Department requested additional information in a Notice of Deficiency letter sent to Great Falls on December 29, 2008. Great Falls' response was received via email on January 13, 2009. The package was deemed complete on January 16, 2009. The permit renewal will incorporate the proposed changes in the modification request.

II. Facility Information

A. Facility Description

The Great Falls WTP is a conventional potable water treatment plant serving approximately 66,000 users. Water from the Missouri River is pumped into the WTP. The WTP is certified through the Department's Public Water Supply (PWS) program under PWSID #MT0000525.

The WTP consists of a rapid sand filtration plant that uses coagulants (including aluminum) to settle out particulate. Great Falls uses chlorine as their primary disinfectant. Chlorine is currently added in the rapid mix basin at the beginning of the treatment process. Ammonia is added at the end of the process, after the clearwell. The addition of ammonia to the chlorinated water creates chloramines, which are considered a secondary disinfectant and maintain residual disinfection in the distribution system. At this time, Great Falls is the only water treatment plant in Montana that treats the water supply in this manner.

The main plant has been expanded a number of times since it was originally built in the early 1900's. The current production of potable water varies between about 8 million gallons per day (mgd) in the winter to a maximum of 40 mgd in the summer, with an annual average of approximately 12.5 mgd. The facility's maximum production rate is currently 40 mgd, based on the facility's 2006 Master Plan [Correspondence from Mike Jacobson, February 26, 2009].

Great Falls also has a Seasonal Treatment Plant, which is an outdoor facility built in 1971 that consists of a permanganate contact basin and additional flocculation and sedimentation basins, for use when the WTP must treat beyond the main plant's treatment capacity (currently over 40 mgd). The Seasonal Treatment Plant is capable of treating up to 16 mgd. The Seasonal Treatment Plant has not been used in at least 14 years, although the drains are left open to drain storm water from the 29,000 square foot area. Because it would require some maintenance and repair to become operable, the seasonal facility would only be used due to a significant increase in water demand. This plant would only discharge when the facility would be taken out of service at the end of the summer.

Wastewater from the main WTP flows into a 200,000-gallon backwash surge tank which functions primarily to equalize the wastewater load, and secondarily to remove sludge for disposal via a sump pump. From the surge tank, the backwash is piped to the dechlorination vault. In the early 2000's, the facility installed an automated ascorbic acid dechlorination system. Shortly thereafter, the facility replaced the ascorbic acid with sodium metabisulfite due to cost.

Wastewater flow is measured by a magnetic flow meter with a totalizer, prior to entering the dechlorination vault. According to Discharge Monitoring Report (DMR) records based on this meter, the average backwash wastewater flow was 0.6 mgd and the maximum was 1.74 mgd during the period of record (POR) 1/31/04 through 12/31/08.

After dechlorination, the wastewater flows to a wet well and into the backwash clarifier, prior to discharge to Outfall 001. The backwash clarifier, installed in 2003, is a concrete clarification basin with mechanical sludge separation that is rated at up to 2.4 mgd. The clarifier was recognized by the Department to be marginally sized, with a design detention time of 1.6 hours rather than the recommended 2-4 hours [DEQ letter 6/17/02]. Great Falls was approved by the Department in late 2008 to modify the clarifier (EQ #09-1156). The facility plans to install flow measuring and sampling equipment as well as other wastewater handling improvements as part of this project.

The Great Falls WTP has two wastewater discharge points to the **Missouri River** under MPDES MT0000442:

> **Outfall 001**: A 24–inch concrete pipe that is the primary wastewater discharge from the main water treatment plant.
>
> **Outfall 002:** A 30-inch concrete pipe that is supplied by a 12-inch line from the Seasonal Treatment Plant, and a 30-inch line from the flume bypass/overflow in the main treatment plant's filter building.

The main WTP wastewater discharge consists of the following sources:

- Filter backwash (Outfall 001)
- Basin drainage (Outfall 001)
- Wash water from traveling screens (Outfall 001)
- Storm water drainage (Outfall 001)
- Flume Overflow/Bypass (Outfall 002)

Filter Backwash

The sand filters in the WTP are cleaned by backwashing with chlorinated/chloraminated potable water at periodic intervals, based on pressure drop across the filter. According to Mike Jacobson, it takes approximately 15 minutes to backwash a filter, with a peak flow of 15,000 gallons per minute (gpm). A backwash cycle is limited to a total of 100,000 gallons, which is the capacity of the water holding tank. Since it takes 30 minutes to refill the holding tank (which is filled with chlorinated/chloraminated water), the WTP cannot generate more than 200,000 gallons per hour (gph) or 4.8 mgd backwash. However, since installation of the backwash clarifier in 2003, the WTP wastewater discharge has been limited by the clarifier capacity of 2.4 mgd.

There are two ways that backwash wastewater could potentially short-circuit the wastewater treatment system. First, the backwash surge tank has an open overflow pipe, in case of an emergency overflow, that leads directly to Outfall 001. The inlet for this overflow pipe is located approximately 9 feet above the bottom of the tank. The WTP's Supervisory Control and Data Acquisition (SCADA) system has a level sensor with high level alarm that alerts the operator if the wastewater reaches 8 feet, and allows the operator to discontinue further backwashing until the system is stabilized. The SCADA system continually monitors and records the water level in this tank. There have been no overflows in at least 14 years. If there were, Great Falls would be able to obtain samples and calculate the volume of the discharge.

Secondly, the system has a clarifier bypass located after flow monitoring and dechlorination. This bypass is necessary for maintenance activities or equipment problems requiring the backwash clarifier to be taken out of service for a period of time. Great Falls would have to manually bypass the clarifier. In the event this occurred, they would be able to obtain samples and document flow. Great Falls has not bypassed the clarifier since it's installation in 2003. Discharges under either of these two scenarios would be subject to the requirements under ARM 17.30.1342(13).

Basin drainage

Basin drainage occurs during maintenance activities requiring draining the flocculation, primary sedimentation, or secondary sedimentation basins or clear wells. This activity accounts for the majority of the volume after the filter backwash.

Wash Water from Traveling Screens

Traveling screens used for the raw water intake are washed by chlorinated/chloraminated potable water. The resulting wastewater is currently added, at up to 300 gpm, directly to the clarifier for settling prior to discharge. This wastewater stream is included in any wastewater samples, but is not currently included in the flow records. After the improvements proposed in 2008 are made, the material will be reduced through a grinder prior to treatment by the clarifier, and the new flow meter location will monitor this wastewater stream as part of the total volume discharged.

Storm Water Drainage

There are several manhole and storm drains located in the gravel parking area close to the backwash clarification system. Although the storm water is currently included in the sampling analysis for Outfall 001 (although not the flow measurements), the changes proposed in 2008 would bring the sampler location further upstream to a more accessible location. As a result, storm water will join the discharge to Outfall 001 after the sampling location. Since the storm water is not a regulated wastewater stream, the new monitoring system will be an improvement.

Flume Overflow/Bypass

The other potential wastewater discharge from the main WTP is from the flumes which carry settled water from the water treatment clarification basins to the sand filters as part of the water treatment process. In the case of a failure in the treatment system resulting in non-potable water, Great Falls has the ability to jettison the contaminated water from the treatment plant through the flumes to Outfall 002. Another potential scenario is the automatic overflow of the flumes to prevent flooding at the filter building. For either scenario, Great Falls will be required to comply with the relevant regulations [bypassing under ARM 17.30.1342(13) or upset under ARM 17.30.1342(14)]. An overflow of these flumes has not occurred in at least 20 years.

B. Effluent Characteristics

Table 1 summarizes monthly DMR data for Outfall 001 for the POR of 1/31/04 through 12/31/08.

Table 1: Outfall 001 Effluent Characteristics for the POR 1/31/04 through 12/31/08

Parameter	Location	Units	Previous Permit Limit	Minimum Value	Maximum Value	Average Value	Number of Samples
Flow, Daily Maximum	Effluent	mgd	NA(1)	0.12	1.74	0.6	58
Turbidity	Upstream	NTU	NA(1)	1.7	60	6.5	58
	Downstream	NTU	NA(1)	2.0	57	9.0	44
	Net Increase(2)	NTU	10	-6.4 (decrease)	8.5	1.2	44
Total Suspended Solids	Effluent	mg/L	30/45(3)	2.0	3280	71 (median = 6.0)	58
Dissolved Aluminum	Effluent	mg/L	1.0/1.5(3)	0.10	0.88	0.37	51
pH	Effluent	s.u.	6.0-9.0	6.91	7.83	--	58
Total Residual Chlorine	Effluent	mg/L	--/0.5(3)	0.02	1.83	0.19 (median = 0.05)	58

Footnotes:
(1) No limit in previous permit; monitoring requirement only.
(2) Data not requested in DMRs. Calculated based on DMR upstream & downstream values.
(3) 30-Day Average/ Instantaneous Maximum in milligrams per liter (mg/L)

C. Compliance History

Great Falls was issued a Notice of Violation and Administrative Compliance and Penalty Order (Docket No. WQ-07-08) on November 2, 2007, for exceeding the Total Suspended Solids (TSS) & Total Residual Chlorine (TRC) permit limits. The response submitted to the Department on January 31, 2008 contained a Compliance Plan that included WTP upgrade projects that were reviewed as part of this MPDES renewal.

The discharge from Outfall 001 exceeded the TSS effluent limit of 45 milligrams per liter (mg/L) four times during the POR (exceedences that were included in the 2007 Notice of Violation are indicated below with an asterisk). Note that all of the exceedences occurred after the WTP's backwash clarifier became operational in or around August 2003 [Great Falls letter dated July 31, 2003]:

Table 2: Outfall 001 TSS Exceedences for the POR

Reporting period	TSS (mg/L)
5/04	86
10/27/05	46*
5/31/06	172*
5/31/07	3280*

In addition, the discharge from Outfall 001 exceeded the TRC limit of 0.5 mg/L seven times during the POR, as shown in Table 3:

Table 3: Outfall 001 TRC Exceedences for the POR

Reporting period	TRC (mg/L)
12/21/04	0.63*
2/25/05	0.58*
5/25/05	1.00*
12/21/05	1.83*
1/27/06	0.64*
12/21/06	0.92*
5/29/08	0.59

The Department conducted the most recent compliance inspection of the WTP on May 1, 2007. The Inspection Report included two items to be addressed: the requirements to analyze dissolved aluminum under a test procedure approved under 40 CFR 136, and to add quality assurance and quality control to the sample analysis routine.

III. Rationale for Proposed Technology-based Effluent Limits

A. Scope and Authority

Technology-based effluent limits (TBELs) represent the minimum level of control that must be imposed by a permit issued under the MDPES program, as stated at 40 CFR 125.44(a) and adopted by reference in Administrative Rules of Montana (ARM) 17.30.1344(2)(b). The Department must consider technology available to treat wastewater, and limits that can be consistently achieved by that technology. TBELs are based on currently available treatment technologies and allow the permittee the discretion to choose applicable controls to meet those standards.

The Montana Board of Environmental Review (BER) has adopted performance standards for point source discharges to state waters under Title 17, Chapter 30, Subchapter 12 of the ARM. Under Subchapter 12, the BER adopted by reference 40 CFR Subpart N, which is a series of federal agency rules that adopt TBELs for existing sources and performance standards for new sources [ARM 17.30.1207(1)]. In addition, ARM 17.30.635(3) states that industrial waste must receive, as a minimum, treatment equivalent to the best practicable control technology currently available (BPCTCA) as defined in Subchapter N. However, federal Effluent Limit Guidelines (ELG) have not been promulgated under Subchapter N for discharges of treated wastewater from potable water treatment plants.

The BER has also adopted general treatment requirements that establish the degree of wastewater treatment required to maintain and restore the quality of state surface waters. This rule states that in addition to federal ELGs, the degree of wastewater treatment is based on the surface water quality standards, the state's nondegradation policy, the quality and flow of the receiving water, the quantity and quality of sewage, industrial wastes and other wastes to be treated, and the presence or absence of other sources of pollution on the watershed [ARM 17.30.635(1)].

B. Proposed TBELs: Concentration-based Limits

The Great Falls WTP was previously permitted with TSS TBELs of:

30 mg/L – 30-day average
45 mg/L – instantaneous maximum

This is consistent with the Environmental Protection Agency (EPA) Region VII policy issued in 1977, the Science Applications International Corporation (SAIC) draft "*Model Permit Package – Water Supply Industry*," dated January 30, 1987, and the majority of the WTP permits recently renewed by the Department.

The Department recognizes that the most common treatment for WTP backwash wastewater is similar to treatment by domestic wastewater lagoons. Settling basins can effectively reduce TSS and turbidity from wastewater at a low cost. TSS concentrations in lagoon discharges are limited to 30 mg/L monthly average and 45 mg/L 7-day average as National Secondary Standard effluent limits [40 CFR 133.102] and these limits have

been demonstrated to be consistently achievable in the water treatment industry. The Great Falls WTP will be required to continue to meet TSS TBELs of 30 mg/L monthly average and 45 mg/L daily maximum.

C. Proposed TBELs: Mass-based Limits

ARM 17.30.1345(8) requires that all effluent limits be expressed in terms of mass, except when applicable standards and limits are expressed in terms of other units of measurement. Calculation of any permit limit which is based on production must be based on a reasonable measure of actual production of the facility that corresponds to the appropriate time period [ARM 17.30.1345(2)(b)(i)]. Because the Great Falls WTP is not subject to an ELG or other production- or mass-based limitation, the development of mass-based effluent limits is not required.

D. Nondegradation Load Allocations

The provisions of ARM 17.30.701 - 718 (Nondegradation of Water Quality) apply to new or increased sources of pollution [ARM 17.30.702(18)]. Sources that are in compliance with the conditions of their permit and do not exceed the limits established in the permit or determined from a permit issued by the Department prior to April 29, 1993 are not considered new or increased sources. In addition, activities causing nonsignificant changes in existing water quality are not considered new or increased sources.

Although Great Falls had four exceedences of TSS permit limits during the five-year POR, the Department does not believe that the facility is a new or increased source. Data on the cause of the TSS exceedences is spotty – it is possible that the exceedences were caused by stormwater contribution, which is unregulated, or from technical issues with the sampling equipment. The facility has not had an exceedence in nearly two years; furthermore, both of these potential issues are going to be addressed in the facility's upcoming improvement projects that were approved in 2008.

Nondegradation load allocations for the Great Falls WTP discharge were calculated for TSS and dissolved aluminum as part of the previous permit issuance in 2000. However, for this type of discharger, the Department calculates nondegradation load allocations only for conventional pollutants, such as TSS. Dissolved aluminum is a toxic pollutant and will be subject to a concentration-based limit in the water quality section. Therefore, the previous nondegradation load allocation for aluminum has been removed.

The nondegradation 30-day average load allocation for TSS was calculated in 1999 to be 1,251 lb/day, based on the TSS effluent concentration limit of 30 mg/L and the facility's maximum flow rate of 5.0 mgd. The Department found that the Great Falls WTP was well below the nondegradation allocated load on a 30-day basis during the POR. The nondegradation allocated load and the actual average loads discharged from the facility during the POR are presented below in Table 4. Actual loads for TSS were calculated based on the monthly average flow and 30-day maximum TSS reported on the facility DMRs.

Table 4. Nondegradation and Actual Loads for POR

Nondegradation Allocated Load Limits			Actual Annual Loads				
Parameter	Units	Load	2004	2005	2006	2007[(2)]	2008
TSS –Annual Ave. [(1)]	lb/day	1,251	56	37	137	55	96
TSS- Max Month	lb/day	1,251	203	184	1,176	139	252

Notes:
(1) The average load was calculated based on the reported monthly average flow and 30-day maximum TSS.
(2) One extremely high value in 2007 was discarded since it appeared to be an anomaly. If included, the actual annual load would be 324 lb/day (19,236 lb/day maximum for the month)

Since the data indicate that the facility did not exceed the nondegradation load value, and has not increased flow or undergone any modifications after 1993 that could increase the volume or nature of the discharge, the Department has determined that the WTP discharge is not a new or increased source for the purposes of nondegradation.

IV. Rationale for Proposed Water Quality-based Effluent Limits

A. Scope and Authority

Permits are required to include Water Quality-based Effluent Limits (WQBEL) when technology-based effluent limits are not adequate to protect state water quality standards (40 CFR 122.44 and ARM 17.30.1344). ARM 17.30.637(2) states that no wastes may be discharged that can reasonably be expected to violate any state water quality standards. Montana water quality standards (ARM 17.30.601-670) define both water use classifications for all state waters and numeric and narrative standards that protect those designated uses. New or increased sources, as defined in ARM 17.30.702(18), are subject to Montana Nondegradation Policy (75-5-303, MCA) and regulations (ARM 17.30.701-718).

B. Receiving Water

The Missouri River discharge location is in the Upper Missouri – Dearborn Watershed (Hydraulic Unit Code 10030102), as defined by the United States Geological Survey (USGS).

The discharge is to the reach of Missouri River identified by Montana stream segment MT41Q001_022, defined as the reach from Sheep Creek to Sun River. The Missouri River directly at the area of discharge is classified as "B-1" according to Montana Water Use Classifications, ARM 17.30.610(1)(a). Waters classified B-1 are to be maintained suitable for drinking, culinary, and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl, and furbearers; and agricultural and industrial water supply (ARM 17.30.623).

Downstream from the discharge (approximately 1000 feet) is the beginning of the reach of Missouri River after the confluence with the Sun River. The downstream segment is identified by Montana stream segment MT41Q001_011, defined as the reach from Sun River to Rainbow Dam. This stream segment is classified as B-2. The Great Falls WTP mixing zone extends into this segment.

The Missouri River seven-day ten-year low flow (7Q10) used for deriving limits in this permit was based on data from the Ulm gaging site (USGS station 06078200), which is located upstream of the discharge. Data from this station was used in the previous WTP permit and the 7Q10 was calculated at that time as 2,620 cubic feet per second (cfs, or 1,693 mgd) based on data up to the year 1994. Using the most recent data available (up to 2002) increases the 7Q10 slightly to 2,650 cfs (1,713 mgd), which will be used to calculate effluent limits.

The 2006 303(d) list identifies the Missouri River at the discharge point (MT41Q001_22) as partially supporting aquatic life and cold water fishery. The probable cause of impairment is sedimentation and siltation. Downstream from the discharge, after the confluence with the Sun River, the 2006 303(d) list identifies this section (MT41Q001_011) as not supporting aquatic life, cold water fishery, or drinking water supply, and only partially supporting industrial uses. The most relevant probable causes of impairment include sedimentation and siltation, suspended solids and turbidity.

To date, a total maximum daily load (TMDL) has not been prepared for either segment MT41Q001_22 or segment MT41Q001_011.

C. Mixing Zone

A mixing zone is an area where the effluent mixes with the receiving water and certain water quality standards may be exceeded [ARM 17.30.502(6)]. A mixing zone must be of the smallest practicable size, have a minimum effect on water uses, and have definable boundaries [MCA 75-5-301(4)]. Acute standards for any parameter may not be exceeded in any portion of the mixing zone unless the Department specifically finds that allowing minimal initial dilution will not threaten or impair existing beneficial uses [ARM 17.30.507(1)(b)].

The Department must determine the applicability of a mixing zone [ARM 17.30.505(1)]. Any previously allowed mixing zone will remain designated in a renewed permit, unless there is evidence that the previously allowed mixing zone will impair existing or anticipated uses [ARM 17.30.505(1)(c)]. In the previous permit, the Department defined the standard mixing zone as 3.9 miles from the discharge point, ending immediately below the Black Eagle Dam, based on Best Professional Judgment (BPJ). However, this mixing zone determination made in 1999 does not comply with current standard mixing zone procedures, which are designed to protect existing and anticipated uses of the receiving water.

A standard mixing zone may be granted for facilities which discharge a mean annual flow less than one mgd to a stream segment with a dilution ratio greater than or equal to 100:1

[ARM 17.30.516(3)(a)]. The mean average flow from the Great Falls WTP is 0.6 mgd, and the dilution ratio with the Missouri River is 2,855:1 (1,713 mgd 7Q10 stream flow / 0.6 mgd mean annual discharge).

In accordance with standard mixing zone procedures [ARM 17.30.516(4)], the length of a standard mixing zone must not extend downstream more than the most restrictive of:

- One-half mixing width distance; or
- Ten times the stream width.

The Department does not have data to determine 'one-half mixing width distance.' However, ten times the stream width would equate to a mixing zone of one mile (10 x 0.1 mile Missouri River width, based on an online satellite photo in Topofinder II in NRIS). Since a one-mile mixing zone is smaller than the existing mixing zone of 3.9 miles, it meets the intent of 'the smallest practicable size' requirement in conformance with MCA 75-5-301(4). Until the Department can obtain sufficient data to compare against the mixing width distance in accordance with ARM 17.30.516(4), the WTP mixing zone should be restricted to one mile downstream from Outfall 002 (which is further downstream than Outfall 001).

Since the mean average flow from the Great Falls WTP is less than one mgd, and the dilution ratio with the Missouri River is greater than 100:1, discharge limits are based on dilution with 100% of the 7Q10 [ARM 17.30.516(3)(a)]. The use of this dilution flow (1,713 mgd) will apply only to chronic parameters (aluminum and TRC).

Compliance with acute parameters has historically been at the end-of-pipe. However, in Appendix D of the USEPA Region VIII 1994 memo "*Transmittal of Mixing Zones & Dilution Policy*," the USEPA recognized that although this policy is recommended, they will also approve mixing zone policies that allow for a zone of initial dilution on a case-by-case basis.

In accordance with ARM 17.30.507(1)(b), the Department finds that allowing a limited acute mixing zone for TRC will not threaten or impair existing beneficial uses. The Department has determined that the maximum daily limit for TRC will be based on 26.5 cfs, which is 1% of the 7Q10. This finding is based on the understanding that TRC is not persistent and typically exhibits first order decay in the receiving water. The Department believes that limiting dilution to 1% of the critical receiving water flow for parameters such as chlorine, ammonia and dissolved oxygen for existing facilities with incomplete mixed discharges, such as the Great Falls WTP, will not result in acute lethality or block passage of migrating organisms.

D. Applicable Water Quality Standards and Proposed WQBEL/Waste Load Allocation (WLA)

Discharges to surface waters classified B-1 are subject to the specific water quality standards of ARM 17.30.623 (March 31, 2006), Department Circular DEQ-7 (February 2008), as well as the general provision of ARM 17.30.635 through 637. In addition to these standards, dischargers are also subject to ARM 17.30 Subchapter 5 (Mixing Zones, March 2006) and Subchapter 7 (Nondegradation of Water Quality, March 2006).

Pollutants typically present at potable water treatment plants that may cause or contribute to a violation of water quality standards include conventional pollutants such as TSS and pH, non-conventional pollutants such as turbidity, and toxics such as TRC and dissolved aluminum. In addition, other pollutants may be present in the Great Falls WTP wastewater discharge due to the chlorination/chloramination process, including the following parameters with water quality standards in Circular DEQ-7: ammonia, total inorganic nitrogen, total Trihalomethanes (TTHM), and n-nitrosodimethylamine (NDMA). Another disinfection byproduct that is expected present in the wastewater, five haloacetic acids (HAAA5s), has water quality standards proposed for inclusion in Circular DEQ-7.

Effluent limits are required for all pollutants which demonstrate a reasonable potential to exceed numeric or narrative standards. The Department uses a mass balance equation to determine reasonable potential based on *EPA Technical Support Document for Water Quality based Toxics Control (TSD)* (EPA/505/2-90-001). Input parameters are based on receiving water concentration, maximum projected effluent concentration, flow of the wastewater treatment facility (average flow for industrial sources), and the applicable receiving water flow.

1. Conventional Pollutants

The TBEL identified in Part III is sufficient to limit TSS. No additional WQBEL will be required for this parameter.

The previous permit limited the effluent pH to 6.0 – 9.0 s.u.. No additional WQBEL will be required for pH, since this limit is protective of the receiving water quality. The pH limit will remain 6.0 -9.0 s.u. in this renewed permit.

2. Non-conventional Pollutants

Turbidity is a non-conventional pollutant from the Great Falls WTP. The previous permit limited the maximum increase above naturally occurring turbidity to 10 nephelometric turbidity units (NTU) based on the proximity of the discharge to waters classified as B-2 (after the confluence of the Sun River with the Missouri River). The previous permit required monthly turbidity monitoring upstream and downstream from the Great Falls WTP discharge. Review of the DMR data shows that the WTP turbidity remained within limits for the POR.

Upon review, the Department determined that the previous limit was not sufficient to protect the waters at the point of discharge, which are classified as B-1. Water quality standards for Class B-1 water restricts turbidity to less than 5 NTU increase above background [ARM 17.30.623(2)(d)]. Furthermore, the method for demonstrating compliance in the previous permit, by comparing upstream and downstream turbidity, is cumbersome and difficult to enforce.

In order to maintain compliance with the 5 NTU increase, the Department proposes in this permit renewal to restrict the turbidity in the WTP effluent. The NTU limitations will be based on upstream information provided in the WTP DMRs since 2002. A statistical evaluation of the data provided:

	CHRONIC	**ACUTE**
RECEIVING WATER BACKGROUND DATA (Upstream)	**ALL**	**RUNOFF (May & June)**
Sample Size	82	13
NTU Average	6.7	17.5
Standard Deviation	7.5	13.4
95% Confidence	1.6	7.3
Protective Mean w/95% Confidence	**5.1**	**10**
RECEIVING WATER STANDARD		
Allowable NTU Increase	**5**	**5**
EFFLUENT DETERMINATION		
NTU Effluent Limit @ End of Pipe	**10**	**15**

See Attachment #1 for the determination of final effluent turbidity limitations.

The background turbidity of the receiving water was calculated from the lower bound estimate of the 95% confidence interval on the mean for the 82 data points over the past seven years (6.7 – 1.6 = 5.1). The allowable increase of 5 NTU for B-1 receiving water was applied to this value (5.1 + 5 = 10.1, rounded to 10), as the average monthly limit.

During periods of runoff, the lower bound estimate of the 95% confidence interval on the mean was higher (17.5 – 7.3 = 10.2) This was based on 13 samples taken for May & June over the past seven years, which represents a worst-case condition. The allowable increase of 5 NTU for B-1 receiving water was applied to this value (10.2 + 5 = 15.2, rounded to 15), as the maximum daily limit.

It is unknown if other non-conventional pollutants, such as ammonia, total nitrogen, or total dissolved solids, are discharged from the WTP because monitoring data was not supplied as part of this application. Monitoring for these and other pollutants will be required as a condition of this permit.

3. Toxic Pollutants

As previously stated, the Department uses a mass balance equation to determine Reasonable Potential (RP) based on the TSD. The mass balance equation to determine RP is presented in Equation 1.

$$C_{RP} = \frac{C_E Q_E + C_S Q_S}{Q_E + Q_S} \qquad \textbf{(Equation 1)}$$

Where:
C_{RP} = receiving water concentration after mixing, mg/L
C_E = projected maximum effluent concentration, mg/L
C_S = receiving water concentration upstream of discharge, mg/L
Q_S = applicable receiving water flow, mgd
Q_E = facility flow rate, mgd

C_E = Maximum Observed * RP Multiplier (TSD Table 3-2)

The result (C_{RP}) is compared to the water quality-based standard. If C_{RP} exceeds the standard values, RP is shown to exist and an effluent limit must be calculated using the mass balance equation (Equation 2)

$$EL = \frac{C_{stnd}(Q_s + Q_e) - Q_s C_s}{Q_e} \qquad \textbf{(Equation 2)}$$

Where:

EL = calculated effluent limit, mg/L
C_{stnd} = applicable standard, mg/L
Q_s = applicable receiving water flow, mgd
Q_e = facility flow rate, mgd
C_s = receiving water concentration upstream of discharge, mg/L

Dissolved Aluminum – Dissolved aluminum is a toxic parameter with standards applicable to surface waters with a pH between 6.5 and 9.0 s.u. [DEQ-7, February 2008]. The chronic water quality standard for dissolved aluminum is 0.087 mg/L and the acute water quality standard for dissolved aluminum is 0.75 mg/L [DEQ-7, February 2008].

The chronic limit in the previous permit was 1.0 mg/L for a 30-day average. The average dissolved aluminum concentration for the POR was 0.37 mg/L.

The acute limit in the previous permit was 1.5 mg/L instantaneous maximum. The maximum daily dissolved aluminum concentration for the POR was 0.88 mg/L.

Attachment #2 presents the chronic and acute dissolved aluminum effluent limits based on 95% confidence to ensure the limit is protective of the chronic and acute water quality standards. Dissolved aluminum data for the Missouri River was available in STORET for seven samples in various locations: all of them provided "nondetect" results with a detection limit of 0.03 mg/L. Therefore, the background concentration of dissolved aluminum was determined to be 0.015 mg/L, based on using half of the detection limit.

Using the chronic dilution flow of 2,650 cfs (100% of the 7Q10), the proposed average monthly limit for dissolved aluminum is 0.52 mg/L. The Department determined that it is not appropriate to use any acute dilution flow. The resulting maximum daily limit for dissolved aluminum is proposed at 0.71 mg/L. Both of these limits will apply at end of pipe.

Total Residual Chlorine (TRC) – The TRC concentration limit in the previous permit was an instantaneous limit of 0.5 mg/L.

The acute water quality standard for TRC is 0.019 mg/L [DEQ-7, February 2008]. Since chlorine dissipates rapidly, and there are no known nearby sources of chlorine upstream of the Great Falls WTP, the background concentration of TRC in the Missouri River is assumed to be 0 mg/L. The TRC effluent value for determining RP is calculated to be 3.29 mg/L based on Equation 1 (1.83 mg/L maximum TRC concentration during POR x 1.8). An acute TRC effluent limit will be developed with this renewal, since RP exists to exceed the acute water quality standard.

The chronic water quality standard for TRC is 0.011 mg/L [DEQ-7]. As stated in the previous paragraph, chlorine dissipates rapidly so there is assumed to be no background concentration of chlorine. The RP value for chronic conditions is the same as for acute conditions. A chronic TRC effluent limit will be developed with this renewal, since RP exists to exceed the chronic water quality standard.

Attachment #3 presents the acute and chronic TRC effluent limits based on 95% confidence. Using the acute dilution flow of 26.5 cfs (1% of the 7Q10), the proposed maximum daily limit for TRC is 0.55 mg/L. However, in order to ensure no backsliding [40 Code of Federal Regulations (CFR) 122.44(l)(1)], the Department will maintain the 0.5 mg/L TRC instantaneous maximum limit in the previous permit (revised to 0.50 mg/L for significant digits) as the acute limit. Using the chronic dilution flow of 2,650 cfs (100% of the 7Q10), the proposed average monthly limit for TRC is 0.25 mg/L. Both of these limits will apply at end of pipe.

Analytical methods in 40 CFR Part 136 requires chlorine samples to be analyzed immediately. On-site analysis for TRC using an approved method is required. The method must obtain a minimum detection level of at least 0.1 mg/L.

Disinfection Byproducts – As previously discussed, the reaction of chlorine with ammonia forms chloramine compounds (chloramines, NH_2Cl). Chloramines extend the time for disinfection in the water distribution system. The chloraminated water is used for the WTP filter backwashing and is, therefore, the source of the facility backwash wastewater.

The backwash wastewater treatment system includes dechlorination by sodium metabisulfite. However, chloramines are less reactive than chlorine and may be less likely to be "dechlorinated." It is unknown how much of the chloramines are discharged, and how much are dechlorinated into chlorine byproducts, ammonia and other nitrogen-based compounds. In addition, the reaction of chlorine in the backwash water with any organic substances trapped in the filters, or in the raw water screen material wash water, may form carcinogens such as total trihalomethanes (TTHM), haloacetic acids (HAA5), or N-nitrosodimethylamine (NDMA) that would be discharged in the wastewater. Great Falls tests drinking water for TTHM and HAA5 levels (in 2007 the results were 24.1 – 43.2 ppb TTHM and 19.1-41.0 ppb HAA5). Great Falls has not provided any NDMA analysis results for the drinking water, or wastewater results for any of these disinfection byproducts.

In order to determine whether there is reasonable potential to exceed water quality standards in DEQ-7 (including the proposed HAA5 standards), the Department will require semi-annual monitoring of these potential disinfection byproducts for this permit cycle.

V. Final Effluent Limits for Outfalls 001 and 002

Final effluent limits for Outfalls 001 and 002 in Table 5 are effective immediately upon the effective date of the permit.

Table 5: Proposed Final Effluent Limits for Outfalls 001 and 002

Proposed Effluent Limits [1]				
Parameter	Units	Sampling Location	Average Monthly Limit	Maximum Daily Limit
Total Suspended Solids	mg/L	Effluent	30	45
Turbidity	NTU	Effluent	10	15
Total Residual Chlorine	mg/L	Effluent	0.25	0.50
Dissolved Aluminum	mg/L	Effluent	0.52	0.71
Footnotes: (1) See Definition section at end of permit for explanation of terms.				

Effluent pH shall remain between 6.0 and 9.0. For compliance purposes, any single analysis and/or measurement beyond this limit shall be considered a violation of the conditions of this permit.

VI. Monitoring Requirements

A. Outfall 001

Monitoring of the effluent at Outfall 001 must be representative of the volume and nature of the discharge. Outfall 001 samples must be obtained from the discharge pipe after the clarification basin, before the wastewater enters the Missouri River.

Table 6: Effluent Monitoring Requirements for Outfalls 001 & 002

Effluent Monitoring Requirements[1]			
Parameter	**Unit**	**Frequency of Analyses**	**Sample Type**
Flow	mgd	Continuous	Instantaneous
Turbidity	NTU	5/Week	Grab
Total Suspended Solids	mg/L	5/Week	Grab
Dissolved Aluminum	mg/L	1/Week	Grab
Total Residual Chlorine	mg/L	1/Day	Grab
pH	s.u.	5/Week	Instantaneous
Total Dissolved Solids (TDS)	mg/L	2/Year	Grab
Total Ammonia, as N	mg/L	2/Year	Grab
Total Nitrogen[2]	mg/L	2/Year	Grab
Free Residual Chlorine	mg/L	2/Year	Grab
Total Trihalomethanes (TTHM)	µg/L	2/Year	Grab
Haloacetic Acids, 5 (HAA5)	µg/L	2/Year	Grab
n-Nitrosodimethylamine (NDMA)	µg/L	2/Year	Grab

Footnotes:
(1) See Definition section at end of permit for explanation of terms.
(2) Total Nitrogen is the sum of Total Kjeldahl Nitrogen (TKN) and nitrate + nitrites.

Analytical methods in 40 CFR 136 requires TRC samples to be analyzed immediately. On-site analysis for TRC using an approved method is required. The method must achieve a minimum detection level of 0.1 mg/L.

Semi-annual monitoring of various pollutants, including TDS, total ammonia, total nitrogen, TTHM, HAA5, and NDMA will be required for Outfall 001, to be used to assess RP for the next permit renewal. Each semi-annual monitoring event must be conducted no less than four months and no more than eight months from the previous sample.

B. Outfall 002

Monitoring of the effluent at Outfall 002 must be representative of the volume and nature of the discharge. If no discharge occurs during the entire monitoring period, it shall be stated on the Discharge Monitoring Report Form (EPA No. 3320-1) that no discharge or overflow occurred.

Outfall 002 samples must be taken before the wastewater enters the Missouri River, as per the monitoring and reporting plan required to be developed under the Special Conditions Section (see Section VII of this SOB).

Table 7: Effluent Monitoring Requirements for Outfall 002

Effluent Monitoring Requirements[1]			
Parameter	**Unit**	**Frequency of Analyses[2]**	**Sample Type**
Flow	mgd	Continuous	Instantaneous
Turbidity	NTU	5/Week	Grab
Total Suspended Solids	mg/L	5/Week	Grab
Dissolved Aluminum	mg/L	1/Week	Grab
Total Residual Chlorine	mg/L	1/Day	Grab
pH	s.u.	5/Week	Instantaneous

Footnotes:
(1) See Definition section at end of permit for explanation of terms.
(2) If the discharge is intermittent, samples must be taken at the beginning of the discharge event.

Analytical methods in 40 CFR 136 requires TRC samples to be analyzed immediately. On-site analysis for TRC using an approved method is required. The method must achieve a minimum detection level of 0.1 mg/L.

VII. Special Conditions/Compliance Schedules

ARM 17.30.1342(8) requires that the permittee furnish to the Department, within a reasonable time, any information to determine compliance with this permit. ARM 17.30.1342(10) requires that samples and measurements must be representative of the monitored activity. In addition, 75-5-602, MCA provides that the Department may require the owner/operator of any point source to install, use and maintain monitoring equipment, and to provide this information as may be reasonably required by the Department.

Within 180 days from the effective date of this permit, Great Falls must develop a plan for monitoring of flow and water quality of discharges from the following potential wastewater sources, and submit it to the Department:

1. Backwash surge tank overflow to Outfall 001
2. Backwash clarifier bypass to Outfall 001
3. Overflow or jettison of treated water through flumes to Outfall 002
4. Seasonal Plant discharge to Outfall 002

The plan must include sampling and analysis methods for documenting flow volume and demonstrating compliance with the effluent limits contained in the permit under Table 5 that the facility will use effective from the date of the plan submittal.

VIII. Other Information

On September 21, 2000, a US District Judge Molloy issued an order stating that until all necessary TMDLs under Section 303(d) of the Clean Water Act are established for a particular water quality limited segment, the State is not to issue any new permits or increase permitted discharges under the MPDES program. The order was issued under the lawsuit Friends of the Wild Swan vs. US EPA *et al*, CV 97-35-M-DWM, District of Montana, Missoula Division.

The renewal of this permit does not conflict with Judge Molloy's order because the permitted discharge does not represent a new or increased source of pollutants.

IX. Information Sources

Federal Water Pollution Control Act (Clean Water Act), 33 U.S.C. §§ 1251-1387, October 18, 1972, as amended 1973-1983, 1987, 1988, 1990-1992, 1994, 1995 and 1996.

US Code of Federal Regulations, 40 CFR Parts 122-125, 130-133, & 136.

Montana Code Annotated (MCA), Title 75-5-101 *et seq*., "Montana Water Quality Act," 2003.

Administrative Rules of Montana Title 17 Chapter 30 - Water Quality

- Subchapter 2 - Water Quality Permit and Application Fees, December 2006.
- Subchapter 5 - Mixing Zones in Surface and Ground Water, March, 2006.
- Subchapter 6 - Montana Surface Water Quality Standards and Procedures, March 2006.
- Subchapter 7- Nondegradation of Water Quality, March 2006.
- Subchapter 12 - Montana Pollutant Discharge Elimination System (MPDES) Standards, March 2007.
- Subchapter 13 - MPDES Permits, March 2006.

Montana Department of Environmental Quality Circular DEQ-7, Montana Numeric Water Quality Standards, February 2008

MPDES Permit Number MT000042:

- Administrative Record.
- Renewal Application EPA Forms 1 and 2A, 7/1/2004 and 12/4/2008

Great Falls Public Water System Source Water Delineation and Assessment Report November 20, 2002

2006 Integrated 303(d)/305(b) Water Quality Report for Montana December 2006

US Department of the Interior Geological Survey, Statistical Summaries of Streamflow in Montana and Adjacent Areas, Water Years 1900 through 2002, Scientific Investigations Report 2004-5266, 2004.

US EPA *Technical Support Document for Water Quality-based Toxics Control*, EPA/505/2-30-001, March 1991.

US EPA National Pollutant Discharge Elimination System (NPDES) Permit Writers' Manual, EPA 833-B-96-003, December 1996.

Washington State NPDES General Permit for Water Treatment Plants –Fact Sheet, June 16, 2004.

US EPA Region VII Policy, "*BPT Water Treatment Plants*," From Ronald D. McCutcheon, February 24, 1977.

Federal Register notice dated November 15, 2000 (Volume 65, Number 221)

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Date: February 27, 2009

Figures 1 -3: Flow diagrams for Great Falls Water Treatment Plant.